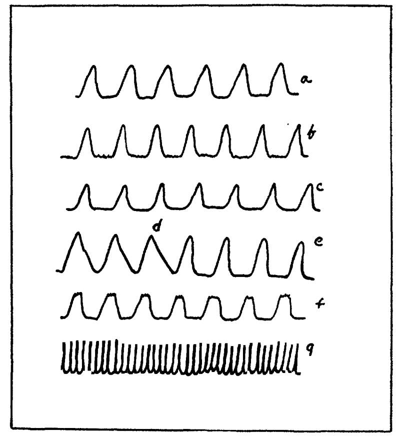
Mary Clark Thompson Medal: Awarded to Francis Arthur Bather, of Wimbledon, England, for his distinguished services in the fields of paleontology and geology. His principal scientific contributions are his Crinoidea of Gotland, published in Stockholm in 1893, his work on the Triassic echinoderms of Bakony in 1909, his chapters on echinoderms in Lankester's treatise on zoology, his contribution on the Cystidea from Girvan in 1913, and his studies in the Edrioasteroidea in 1915. These are in addition to many other papers on geological and biological subjects covering the field of fossil invertebrates though relating mainly to crinoids. He also has made important contributions on museum technique. The Mary Clark Thompson Fund, which makes the award of this medal possible, was established by gift of Mrs. Thompson in 1919. Seven previous awards have been made as follows: To Charles Doolittle Walcott, 1921; Emmanuel de Margerie, 1923; John Mason Clark, 1925; James Perrin Smith, 1928; William Berryman Scott, 1930; Edward Oscar Ulrich, 1930, and David White, 1931.

SCIENTIFIC APPARATUS AND LABORATORY METHODS

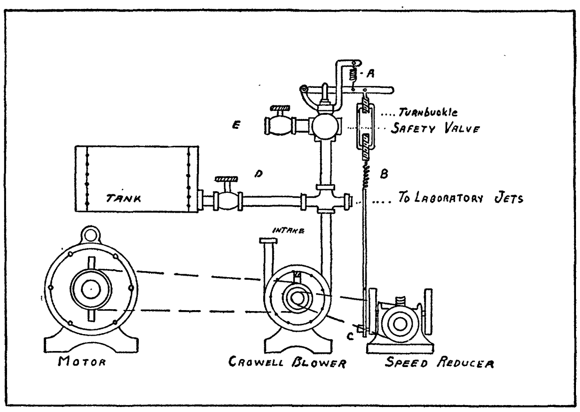
AN APPARATUS FOR MAINTAINING ARTIFICIAL RESPIRATION IN LABORATORY ANIMALS

Some mechanical device for carrying out artificial respiration in laboratory animals is practically an indispensable piece of equipment in the physiological laboratory. It has not been long since experimenters resorted to hand or foot bellows for the performance of this necessary procedure. These have been gradually replaced by more elaborate mechanical machines, in which the volume and rate of the output may be varied as desired. One of the most popular methods particularly for student experiments, employs an ordinary wind-shield wiper as a means of interrupting a current of air. In some laboratories motor-operated rotary valves are inserted in the air-line leading to the laboratory tables. Still others find it practical to equip each mammalian group with special apparatus for instituting artificial respiration. As desirable as this seems, the facilities of many laboratories do not permit such an expenditure, and therefore, recourse is made to some of the simpler and less expensive methods, except where certain research problems are involved.

For more than eight years the simple device described in this article has been in use in this laboratory, and having given most satisfactory service with practically no attention, it is reported here for whatever value it might be to other laboratories. The Crowell blower, designed for volume output, is probably more desirable than other types of air pumps which are capable of higher pressures. There is little danger of rupturing the lungs from the full pressure exerted by many of these rotary blowers. The tank placed in the line acts as a buffer and serves to regulate the degree of lung inflation, as well as governing the rate of inflation with respect to the total duration of the respiratory phase. As a means of interrupting the current of air an ordinary safety valve, in the line, as shown in the accompanying diagram, is readily adapted. This valve is mechanically operated by a rod connecting to cam C on the speed-reducing gear. The tension of spring H is so adjusted that the



safety valve is held open when the cam is in the "up" position, and the air output of the blower escapes through valve E. The turnbuckle, by adjusting the tension of spring B, regulates the time of closing and opening of the safety valve. By increasing the tension on this spring the safety valve remains closed through a greater arc in the revolution of the speed reducer, and therefore prolongs the inspiratory phase. Valve E regulates the rate of de-



flation or the duration of the expiratory phase. No special valves in the main air line leading to the laboratory tables are necessary, since the resistance of this line is so much greater than through the safety valve, the pressure at the laboratory jets drops practically to zero when the safety valve is opened. By regulating the opening of the air cocks on the laboratory table, the volume of air delivered can be varied according to the requirements of the animal. It may be found necessary, when experiments are conducted simultaneously on a large number of animals, to slightly close valves E and D, and to increase the tension on spring B. The respiratory rate is regulated by means of step pulleys on the motor or pump shaft. Inexpensive reducing gears of 48 : 1 ratio are available from most dealers in laboratory equipment. A further reduction of 2 : 1 for motors operating at 1750 R.P.M. is necessary, and gives an approximated respiratory rate of 20 per minute.

That the method for maintaining artificial respiration described in this article is capable of producing a variety of respiratory curves, and is readily adapted to most laboratory requirements, may be readily seen from the accompanying graphs.

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A SPECIAL AIR-CHAMBER FOR STUDYING PHOTOSYNTHESIS UNDER NATURAL CONDITIONS

IN studies of photosynthesis under natural conditions with the apparatus recently described by Heinicke and Hoffman,[1] the use of a Cellophane or plastacele envelope as a leaf chamber has distinct advantages over larger containers. However, when the leaf is exposed for a prolonged period to the direct rays of full sunlight, the temperature within the envelope, as in all chambers in which the leaf is wholly enclosed, may rise 6 to 10 degrees C. above that prevailing outside.

This difficulty can be avoided with the apple and with other species in which the stomates are confined to the lower side of the leaf by attaching an air-chamber to that side only. The upper surface of the leaf is thus freely exposed to entirely natural conditions with respect to light, temperature and humidity.

The details of an air-chamber which has been used successfully for this purpose are clearly shown in Fig. 1. The chamber is a modified glass funnel which contains a side arm through which the air is supplied. The leaf (B) rests upon a soft rubber or felt rim (C) which extends a few millimeters above the edge of the cup (D).[2] It is firmly held in place by a flat brass ring (A), which in turn is attached to the cup by means of spring clamps (G). The tension of these clamps can easily be adjusted so that the pressure will be sufficient to prevent the free passage of air, but not enough to injure the leaf tissue. The cup is held in position by means of a wire test-tube holder which is attached to the twig or other support. It may be left in place for several days or even for weeks at a time.

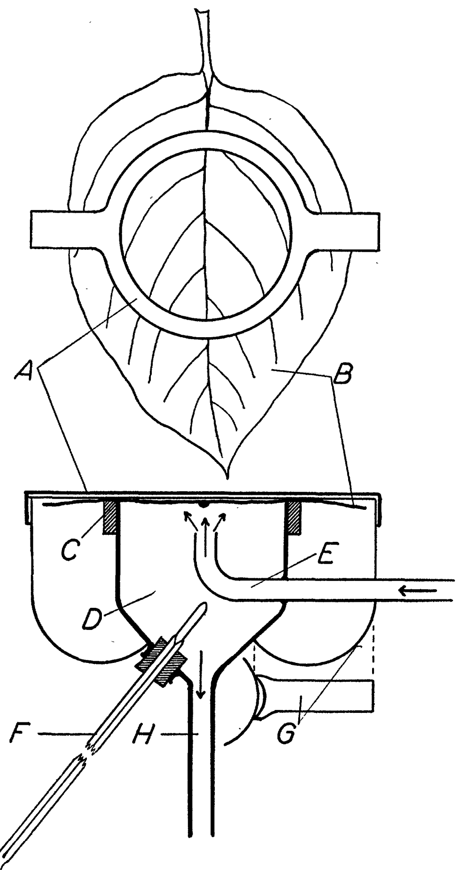

FIG. 1. Diagram of an assimilation chamber used in studies of photosynthesis. The top view is shown above; the cross-section below. The brass ring (A) is used to hold the leaf (B) against rubber cushion (C) of glass cup (D). Air supplied through (E), exhaust through (H). Thermometer, at (F). Top view of spring clamp leading from ring to bottom of cup, at (G).

The fresh air supply is drawn through a glass tube from the side arm (E) which extends from about 10 cm outside the cup to the middle of the chamber. The end of the tube inside the cup is bent so that the leaf lies parallel to and about 1 cm above the opening. The air thus circulates near the under side of the leaf tissue before it passes through the narrow tube at the bottom of the funnel and thence to the absorption towers.

A similar chamber can easily be made without special technique in glass blowing. This consists of

[1] A. J. Heinicke and M. B. Hoffman, SCIENCE 77: 55–58, 1933.

[2] When the rim is coated with a thin layer of soft grafting wax the contact between the leaf and the cup becomes air-tight. The device may thus serve as a porometer for studying the relative size of stomatal aperture at different periods of the day.